

REMARKS

The Official Action dated June 22, 2010 has been carefully considered. Accordingly, the present Amendment is believed sufficient to place the present application in condition for allowance. Reconsideration is respectfully requested.

By the present Amendment, claim 1 is amended to recite that the layer (b) is formed of a polyvalent metal compound and a resin, in accordance with the teachings in the specification, for example at page 19, lines 7-11. Claims 12 and 19-22 are cancelled and claims 23-25 are added. Support for claims 23 and 24 may be found in the specification, for example at page 11, lines 16-21, while support for claim 25 may be found at page 9, lines 16-22 and page 34, lines 18-23. It is believed that these changes do not involve any introduction of new matter, whereby entry is believed to be in order and is respectfully requested.

In the Official Action, claims 1, 5, 7- 15 and 17-22 were rejected under 35 U.S.C. §103(a) as being unpatentable over the Ohba et al PCT WO 99/52973, the Examiner relying on the equivalent Ohba et al U.S. Patent No. 6,605,344 (U.S. '344) as an English translation of WO 99/52973, in view of the Fong U.S. Patent No. 4,786,561. The Examiner asserted it would have been obvious to orient the film of Ohba et al in view of the teachings of Fong in order to obtain and make it heat shrinkable for the barrier packaging art. The Examiner asserted that it would have been obvious to eliminate the polyalcohol in the Ohba et al poly(meth)acrylic layer and the skilled artisan would expect the film to have virtually the same properties since polycarboxylic acid is known to have excellent barrier properties but is humidity sensitive and the polyalcohol improves the resistance to humidity, but the adjacent metal layer also provides crosslinking and a polymeric overlay provides efficient barrier properties to humidity.

However, Applicants submit that the heat-shrinkable multi-layer films according to claims 1, 5, 7-11, 13-15, 17 and 18 are nonobvious over and patentably distinguishable from

the combination of Ohba and Fong. Accordingly, this rejection is traversed and reconsideration is respectfully requested.

More particularly, the present invention is directed to a multi-layer film which is both heat shrinkable and exhibits excellent oxygen barrier properties, even after heat shrinkage. As defined by claim 1, the multi-layer film comprises a heat-shrinkable base film and, provided on at least one surface of the base film, at least one layer structure including a layer (a) formed of a poly(carboxylic acid) polymer (A) and free of polyalcohol, and a layer (b) formed of a polyvalent metal compound (B) and a resin, the layers (a) and (b) being in contact with each other. The layer structure is not oriented, yet the multi-layer film and the base film each exhibit a percent thermal shrinkage in at least one direction of 5 to 90% as measured by immersing the respective film in hot water at 90°C for 30 seconds and the multilayer film exhibits an oxygen permeability of $100 \text{ cm}^3/(\text{m}^2 \cdot \text{day} \cdot \text{MPa})$ or less as measured at 30°C and a relative humidity of 80% after thermal shrinkage treatment.

It is surprising and nonobvious that a multilayer film including a gas barrier, non-oriented layer structure of a polymer layer (a), free of polyalcohol, and a layer (b) containing a polyvalent metal and resin as claimed, formed on a heat shrinkable base film, exhibits heat shrinkability without impairing the good gas barrier properties of the film. In this regard, the Examiner's attention is directed to Table 1 at page 37 of the present application which shows the low oxygen permeability exhibited by the claimed multi-layer films, both before and after thermal shrinkage treatment.

In the heat-shrinkable multi-layer film according to the present invention, most of the poly(carboxylic acid) polymer (A) in layer (a) is present as an ionic crosslinked product with a polyvalent metal owing to an ionic reaction which occurs between the carboxyl groups of the poly(carboxylic acid) polymer and polyvalent metal ions which have migrated from the layer (b). One skilled in the art will appreciate that such ionic crosslinking is dependent on

formation of the polyvalent metal ion from the polyvalent metal compound (B) and on appropriate migration of the formed polyvalent metal ion from the layer (b) into the layer (a), both of which occur satisfactorily in the absence of a heating step which was conventionally employed in the prior art. Moreover, the resulting layer structure advantageously and surprisingly will follow the heat shrinkage of the base film, without delamination of the layers (a) and (b) and without delamination of the layer structure from the base film, and the good gas barrier properties are maintained.

The multi-layer films of the present invention are distinguishable from the combination of Ohba et al and Fong in several important respects. First, Ohba et al clearly teach the use of a polyalcohol and a heat treatment to obtain gas barrier properties. While the Examiner has asserted that the minimum 1% polyalcohol of Ohba et al renders the omission of polyalcohol obvious to one skilled in the art, whereby the heat treatment can also be omitted, the Examiner's position simply ignores the remaining teachings of Ohba et al and improperly relies on the teachings of the present specification. That is, Ohba et al teach:

“The present inventors have found that the aforementioned problems can be solved by a gas-barrier film which is produced through application of a layer containing a metallic compound (hereinafter the layer may be referred to as a "metallic-compound-containing layer") to the surface of a polymer layer **formed from a mixture of a polyalcohol and at least one poly(meth)acrylic acid polymer** selected from the group consisting of poly(meth)acrylic acids and partially neutralized poly(meth)acrylic acids” (column 1, line 66-column 2, line 7, emphasis added).

Thus, Ohba et al's own characterization of their invention includes the use of a polyalcohol in the poly(meth)acrylic acid layer. Further, Ohba et al teach:

“In the present invention, **in order to impart some degree of water-resistance and gas-barrier properties to the polymer layer, at least the polymer layer is preferably subjected to heat treatment.** In addition, the polymer layer must be adjacent to a metallic-compound-containing layer or a layer of a mixture of metallic compound and resin” (column 3, lines 48-54, emphasis added).

Similarly, Ohba et al teach:

“After completion of **heat treatment**, the resultant polymer layer has water resistance and **exhibits excellent gas-barrier properties under high humidity**” (column 9, lines 51-54, emphasis added).

As the multi-layer film of claim 1 exhibits an oxygen permeability of 100 $\text{cm}^3/(\text{m}^2\cdot\text{day}\cdot\text{MPa})$ or less as measured at 30°C and a relative humidity of 80% after thermal shrinkage treatment, one skilled in the art would have employed Ohba et al’s preferred heat treatment to obtain the indicated water-resistance and gas-barrier properties to the polymer layer and would not, as asserted by the Examiner, omitted either the polyalcohol or the heat treatment.

While the teachings of a patent are not limited to the examples, each and every one of Examples 1-58 of Ohba et al employ at least 10 weight percent of a polyalcohol and a heat treatment at a temperature in the range of 160°C-230°C. These exemplary teachings of Ohba et al surely do not suggest to one of ordinary skill in the art that the polyalcohol can be omitted and/or the heat treatment can be omitted if a product having good barrier and moisture resistant properties is desired. Thus, despite the lower limit of polyalcohol taught by Ohba et al being 1 weight percent, the Ohba et al teachings, properly viewed in their entirety, do not suggest to one of ordinary skill in the art that the polyalcohol and the heat treatment can be omitted to provide a heat shrinkable multi-layer film which exhibits an oxygen permeability of 100 $\text{cm}^3/(\text{m}^2\cdot\text{day}\cdot\text{MPa})$ or less as measured at 30°C and a relative humidity of 80%, particularly after thermal shrinkage treatment.

Importantly, the heat treatment disclosed in Ohba et al has been determined to adversely affect formation of the polyvalent metal ion from the polyvalent metal compound (B) and the migration of the formed polyvalent metal ion into the layer (a), both of which are required to obtain the multilayer film of the present invention. That is, it has been determined that the heat treatment disclosed in Ohba et al, conducted at 160 to 230°C as in Ohba et al’s Examples 1-58, on a layer structure of a layer (b) comprising a polyvalent metal compound

(B) and a resin, formed on a layer (a) comprising a poly(carboxylic acid) polymer (A) and being free of a polyalcohol, significantly reduces a medium or carrier for causing ionization and accelerating migration of the metal ion into the layer (a) as compared with a case where no heat treatment is conducted. Therefore, the formation of the polyvalent metal ion from the polyvalent metal compound and the migration of the polyvalent metal ion into the layer (a) become difficult, as is the formation of the ionic crosslinked product of the poly(carboxylic acid) polymer with the polyvalent metal ion in the layer (a).

Applicants have previously demonstrated that the prior art has recognized that the Ohba et al heat treatment is necessary for forming an ester bond between a carboxyl group of the poly(meth)acrylic acid polymer and a hydroxyl group of the polyalcohol and improves water resistance. See the discussion of Tanaka (US 6,022,913) in Applicants' previous response. In contrast, the heat-shrinkable multi-layer film according to the present invention, based on the ionic reaction between the metal ion and the carboxylic acid polymer, does not employ esterification and therefore does not employ either the polyalcohol of Ohba et al or the heat treatment of Ohba et al.

The Examiner has asserted that the adjacent metal layer of Ohba et al provides crosslinking and a polymeric overlay provides sufficient barrier properties to humidity. However, the metal layer of Ohba et al is not disclosed as crosslinked and Ohba et al employ a metal and resin layer, yet still require the polyalcohol and heat treatment. Moreover, the ionic crosslinking of the carboxylic acid polymer described in the present invention, in the absence of the use of a polyalcohol and a heat treatment, is neither taught, recognized or obtained in the heat treated films of Ohba et al, and the Examiner is therefore improperly relying on the teachings of the present invention to modify the teachings of Ohba et al. There is simply no teaching, suggestion, recognition or other reasoning of record which would have provided one of ordinary skill at the time of filing of the present application in the art with a

reasonable expectation of success in forming a multilayer film with ionic crosslinking sufficient to provide an oxygen permeability of $100 \text{ cm}^3/(\text{m}^2\cdot\text{day}\cdot\text{MPa})$ or less as measured at 30°C and a relative humidity of 80%, particularly after thermal shrinkage treatment, while omitting the polyalcohol and heat treatment of Ohba et al. To the contrary, a heat shrinkable multilayer film having the gas barrier properties recited in claim 1 is unpredictable in view of the Ohba et al teachings.

Such a multilayer film is also unpredictable in view of the Tanaka teachings. The Examiner asserted that Tanaka (US 6,022,913), discussed in Applicants' previous response, teaches that the polyalcohol creates ester bonds which improved hot water resistance, but such properties can also be assured by providing a polymeric overlay on the polycarboxylic acid barrier films. However, Ohba et al teach their metal layer may include resin polymer as well, yet Ohba et al still require a polyalcohol and a heat treatment. Thus, the Examiner's assertions are contrary to the specific teachings of Ohba et al. Moreover, while Tanaka describes ionic cross-linking, Tanaka nonetheless employs esterification by use of a polyalcohol. Tanaka specifically discloses that the esterification is first conducted as follows:

“After forming cross-linked structure by ester bonds between poly(meth)acrylic acid (A) and polyalcoholic polymer (B) by a heat treatment of a film-like article formed of a precursor composition comprising poly(meth)acrylic acid (A) and polyalcoholic polymer (B) or a substrate film on which the film-like article is coated, the film-like article or the substrate film on which the film-like article is casted is immersed in a medium, for example water, containing the metal (C). The metal ions in the medium permeate into the film-like article by immersion, forming ionic bonds (ionic cross-linking) with free carboxylic acids originating from poly(meth)acrylic acid in the film-like article after heat treatment” (column 11, lines 42-54, emphasis added).

It is apparent that in the absence of esterification, Tanaka's film-like article could not be immersed in water and still maintain its integrity. Thus, the esterification by a polyalcohol and heat treatment is taught by Tanaka as essential.

Moreover, the Examiner's assertion that Ohba et al employs an additional polymeric overlay which may provide sufficient barrier properties further demonstrates the significant difference between the present invention and the teachings of Ohba et al, namely, that Ohba et al do not teach, suggest or recognize that the multilayer film of the present invention, comprising a heat-shrinkable base film and a layer structure including a layer (a) formed of a poly(carboxylic acid) polymer (A) and free of polyalcohol, and a layer (b) formed of a polyvalent metal compound (B) and a resin, and exhibiting oxygen permeability of $100 \text{ cm}^3/(\text{m}^2\cdot\text{day}\cdot\text{MPa})$ or less as measured at 30°C and a relative humidity of 80%, particularly after thermal shrinkage treatment, is obtainable without using polyalcohol and heat treatment. Clearly, Ohba et al provide no teaching, suggestion or recognition in this manner despite using a metal and resin layer.

Finally, the Examiner has asserted that it would have been obvious to orient the film of Ohba et al as taught by Fong as heat shrinkability is desired in the barrier packaging art. First, this assertion ignores the fact that the films of Ohba et al are heat treated to obtain the desired barrier and moisture resistance properties, so that the films with the desired properties are not heat shrinkable as presently claimed. That is, the Ohba et al heat treatment is significantly more rigorous than the thermal shrinkage treatment recited in claim 1 to obtain 5 to 90% thermal shrinkage of the presently claimed multi-layer films, i.e., immersion in hot water at 90°C for 30 seconds. Accordingly, one of ordinary skill in the art will appreciate that to heat shrink the gas-barrier film of Ohba et al, energy greater than that of the heat treatment in Ohba et al would be required and it would be impossible to heat-shrink the film using less energy than employed in the described heat treatment. In view of the rigorous heat treatment conditions required by Ohba et al, it is apparent that the conditions for obtaining thermal shrinkage in present claim 1, i.e., immersion in hot water at 90°C for 30 seconds, cannot result in a thermal shrinkage of 5 to 90% as required by claim 1 in the films of Ohba

et al. Thus, one of ordinary skill in the art would have no motivation to use the Ohba et al teachings to provide a heat shrinkable film.

Further, it is important to note that the poly(meth)acrylic acid layer of Ohba et al, wherein the polyalcohol forms ester bonds upon the heat treatment, has a molecular structure which is relatively stiff and lacks flexibility, and therefore, if provided on a heat shrinkable base, would typically delaminate. In contrast, the multi-layer films of claim 1 have good barrier properties, i.e., they exhibit oxygen permeability of $100 \text{ cm}^3/(\text{m}^2\cdot\text{day}\cdot\text{MPa})$ or less as measured at 30°C and a relative humidity of 80%, and are heat shrinkable. The layer structure follows the heat shrinkage of the base film without delamination. This combination of barrier properties and heat shrinkability is not taught, suggested or recognized in the prior art of record, and, rather, it is surprising and unpredictable in view of the prior art of record.

Fong discloses that a heat-shrinkable barrier film comprising an oriented polyolefin film coated on one side with a vinylidene chloride copolymer may be formed by treating the surface of the polyolefin film prior to coating so as to provide a minimum surface energy of 35 dynes/cm, for example by corona discharge, electro contact or flame treatment. The disclosure of Fong bears no relation to the teachings of Ohba et al. Different base films and different barrier films are employed by Fong as compared with Ohba et al, and different manufacturing processes are employed. In drying the coated layer, Fong avoids temperatures that would effect the shrinkability of the product (see column 3, lines 61-66), while, in contrast, Ohba et al teach the desirability of a heat treatment step of 160°C to 230°C , clearly above that of the heat shrinking temperature of 100°C - 130°C taught by Fong (see column 4, lines 3-4).

The only motivation for the combination of Ohba et al and Fong set forth in the Official Action was "heat shrinkability is desired in the barrier packaging art" (page 3). That Fong discloses barrier films for packaging does not provide an apparent reason to one of

ordinary skill in the art to combine any of the disparate Fong teachings with Ohba et al, particularly with any reasonable expectation of success. To the contrary, the heat treatment required by Ohba et al would lead one of ordinary skill in the art away from the use of the Ohba et al teachings for obtaining a heat shrinkable film. It is error to find obviousness where references diverge from and teach away from the invention at hand, *In re Fine*, 837 F.2d 1071 (Fed. Cir. 1988).

Moreover, as set forth in MPEP §2141:

[T]he key to supporting any rejection under 35 U.S.C. 103 is the clear articulation of the reason(s) why the claimed invention would have been obvious. The Supreme Court in *KSR* noted that the analysis supporting a rejection under 35 U.S.C. 103 should be made explicit. The Court quoting *In re Kahn*, 441 F.3d 977, 988, 78 USPQ2d 1329, 1336 (Fed. Cir. 2006), stated that “[R]ejections on obviousness cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.”

The failure to provide any clear articulation as to why it would have been obvious to combine the selected teachings of Fong with the modified teachings of Ohba et al, as opposed to a general statement of the packaging art, particularly in view of Ohba et al’s use of a high temperature heat treatment, fails to comply with the requirements of MPEP §2141.

In determining patentability under 35 U.S.C. §103, it is necessary to determine whether there was an apparent reason to combine the known elements of the prior art in the fashion of the claims at issue, *KSR International Co. v. Teleflex, Inc.*, 127 S.Ct. 1727, 1740-41 (2007). Here, there is no apparent reason for modifying the teachings of Ohba et al and then combining the modified teachings of Ohba et al and Fong in a manner which results in the claimed multi-layer films having both heat shrinkability and excellent oxygen barrier properties without employing a polyalcohol and without conducting a heat treatment as disclosed in Ohba et al. Accordingly, the combination of Ohba et al and Fong does not render the claimed multi-layer films obvious. The rejection under 35 U.S.C. §103 based on Ohba et al and Fong is therefore overcome. Reconsideration is respectfully requested.

It is believed that the above represents a complete response to the Official Action, and places the present application in condition for allowance. Reconsideration and an early allowance are requested. In the event that the present application is not in condition for allowance, the Examiner is encouraged to telephone the undersigned to resolve any outstanding matters. Please charge any fees required in connection with the present communication, or credit any overpayment, to Deposit Account No. 503915.

Respectfully submitted,

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